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ABSTRACT

The keyword method, originally developed as an instructional technique in foreign language acquisition, was tested for its application in other school learning tasks and as a self-initiated study strategy. Two classes containing a total of 40 eighth grade students served as the experimental and control groups. The tasks were learning to pair technical terms with their definitions and learning to pair proper surnames with facts, events, and accomplishments. After five training sessions the experimental group students were able to carry out the sequence of operations constituting the keyword method, including the generation of concrete keywords and of compound images that bridge keywords and response terms. The experimental group performed significantly better than the control group, exceeding the control group by 40% on the posttest and 36% on the other posttest. Subsequent unprompted tests showed substantially higher performance by students trained in the keyword method than by those students from the control group. (Author/RL)

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School Applications of the Mnemonic Keyword Method as a Study Strategy by Eighth Graders[1]

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Footnote

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Running head: School Applications of the Keyword Method

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School Applications of the Mnemonic Keyword Method as a Study Strategy by Eighth Graders

Abstract

Two questions were addressed regarding the utility of the keyword method, originally developed as an instructional technique to facilitate foreign language vocabulary acquisition. First, is the method applicable to other common school learning tasks? In this case the tasks were (a) learning to pair proper surnames with facts, events, accomplishments, etc., and (b) learning to pair technical terms with their definitions. The second question concerned eighth graders use of the keyword method as a self-initiated study strategy. After five training sessions the students were able to carry out the sequence of operations constituting the keyword method, including the generation of concrete keywords and of compound images bridging keywords and response terms. Subsequent unprompted tests showed substantially higher performance by trained than by untrained students on the two tasks referred to above.

School Applications of the Mnemonic Keyword
Method as a Study Strategy by Eighth Graders

Raugh and Atkinson (1975) recently have described several experiments concerning a study technique for the acquisition of foreign language vocabulary (see also Atkinson, 1975; Atkinson & Raugh, 1975). The technique, referred to as the keyword method, involves two stages. First, the Spanish (or other language) word is recoded into some familiar concrete noun (a keyword) based on similarities in acoustic and/or orthographic properties. For example, the Spanish word HUEVO (pronounced WAVE-OH), meaning EGG, might be recoded as the familiar English word WAVE. The next stage is the production of a compound visual mental image of the objects denoted by the English code word (WAVE) and the English equivalent (EGG). For example, one might imagine an egg bobbing on the crest of a wave. The important points are that the recoding be stable, so that the same English code word (keyword) always occurs when the Spanish word is presented, and that the keyword word and the English equivalent be conducive to the production of a stable compound visual image.

A number of experiments have reported substantial facilitative effects of the keyword method for vocabulary learning both of Spanish nouns (Raugh & Atkinson, 1975) and of Russian nouns (Atkinson & Rough, 1975). Similiar effects with school children have been reported recently by Pressley and Levin (Pressley, 1977); Pressley & Levin, in press).

The present study posed two additional questions of considerable practical importance regarding the utility of the keyword method in a public school setting. First, is the method applicable to tasks other than foreign language vocabulary acquisition? An analysis of the method as a paired associate (PA) study strategy suggests that this broader applicability is likely. The keyword method as examined in the various studies cited above has been effective when the English equivalent is a concrete noun and when there is no obvious relation to begin with between the foreign item and its English equivalent. There are other common school tasks that meet these criteria, and would presumably be amenable to the keyword method. One such task examined in the present research involves the acquisition of the definitions of specialized technical terms, in this case the definition for particular medical problem. We shall refer to this as the Medical Definitions test. Another task that we examined here is one most likely to be found in a history or social studies course, and is one in which the student is required to recall events, places or things relating to particular individuals. This might include the association of inventors with their inventions, explorers with their discoveries, authors with their books, etc. Our version of this task is referred to as the Names and Facts test. These are examples of rote (nonmeaningful) tasks that few enjoy but all must engage in from time to time. To what extent, we asked here, is the keyword method likely to be useful for such tasks?

The second main question addressed in our study concerns the applicability of the keyword method as a student-initiated and controlled study strategy rather than primarily as a method of instruction. To date, the

studies of the efficiency of the method have involved the imposition of the method on the learner. The keyword method is explained and illustrated, then the student is given a vocabulary acquistion task in which he is explicitly instructed to apply the method, and generally supplied with the keywords to use. We can imagine many situations in which the keyword method would be effective but is unlikely to be imposed on, or even suggested to, the student. In fact, at this time at least, these latter conditions are by far the more common. Thus, if the keyword method is to be used, it will have to be initiated and controlled entirely by the learner. Can students be taught to use the method in this way? Can they be trained to adopt the keyword method as a study strategy to be retrieved and applied under appropriate circumstances? Our aim was to begin to provide an answer to this important question. This was done by giving rather intensive training in the use of the keyword method, then observing student performance subsequently on tasks for which the keyword was appropriate but its use was not explicitly prompted.

Two groups (classrooms) of 8th grade students participated in the study. One class was given training in the keyword method; the other class received irrelevant training (described below) and served as the control group. Training occurred in five sessions that gave illustrations and practice in the component steps in the keyword method, and explanations regarding the conditions appropriate to its use. Two unprompted tests for training effects were given, one a week after training and the second still two weeks later. The first of these involved a task essentially identical to one used in training except for the specific items used. The second

task tested for somewhat more general and persisting training effects.

METHOD

Participants and Design

Forty children in two eighth grade classes served as participants. These classes were drawn from a school located in an affluent suburb of Chicago and the children were predominantly upper-middle class in socio-economic backgrounds. For practical reasons intact classes were used, with one class given training in the use of the keyword method and the other class receiving organizational strategy training and serving as a control group for the keyword training condition. School officials indicated that assignments to classes were unsystematic and that the groups were equivalent in ability. Available achievement test scores confirmed the near equivalence of the two eighth grade classes. The mean reading achievement raw scores, averaging the comprehension and vocabulary subtests of the Gates-McGinitie and expressed in raw age equivalent, were 35.97 (SD = 6.11) for the keyword (experimental) training group and 37.57 (SD = 5.37) for the organization (control) training group. It will become clear, we believe, that the nonrandom assignment of subjects to conditions constitutes no problem in the interpretation of training effects.

As indicated above the control group received training for two irrelevant tasks: learning 36 disorganized but cross-classifiable sentences and writing compare-and-contrast essays. The training involved instructing the students to outline the sentences in two-dimensional tables. The tables were then used to organize the paragraph structure of the essays. (Jones

and Hall, 1979).

Several precautions were taken to equalize motivation for the two groups and to control strategy information. First, each group was informed clearly about the nature of their respective training and tasks and warned against inquiring about the training being given the other group. More specifically, the control students were told that they were learning a strategy for memorizing and writing about related (categorizable) facts and that it would be both confusing and dysfunctional to apply the other group's strategy to their task. Second, both groups were told that after each group had learned their respective strategies, there would be a second phase of training in which each individual would be responsible for teaching a member of the other group the strategy that he/she had learned during the first phase of training. This procedure was actually followed in a post-experimental session. Third, both groups were told that from time to time they would receive brief "pretests" for "various strategies" and that these "pretests" would determine whether or not they needed additional strategy training for other types of tasks. It was reasoned that this information would motivate the students in each group to perform at their best on such tests. These "pretests" were in fact, the posttests for the respective groups. That is, the control group believed that the Names and Facts and the Medical Definition task it received for posttest comparisons were pretests for additional training while the keyword group believed that the disorganized sentences task administered them for posttest comparisons were pretests for additional strategy training.

Finally, to prevent inappropriate strategy transfer, each group was specifically cautioned before each of the alleged "pretests" about the problem of inappropriate strategy transfer. Thus, the control group which received cross-classification training for related facts was told that these special "pretests" were pretests for strategies for learning unrelated, uncategorizable information and that they should under no circumstances apply the cross-classification strategy to learn the unrelated names, facts, and definitions. Equivalent warnings were issued to the keyword group with regard to their special "pretests." Thus, we not only specifically discouraged inappropriate strategy transfer for each of the control conditions, but also (indirectly) encouraged the active search for an appropriate strategy for these "pretests."

Training in the Keyword Condition

The keyword training was designed to facilitate performance in a paired associate type of task in which the stimuli are unfamiliar or low meaningfulness items and the responses are familiar and relatively concrete. School-related examples may be found in vocabulary acquisition in classes in English, foreign languages, and any discipline in which there are a substantial number of technical terms that must be acquired. The objective is to teach the student to recode the unfamiliar stimulus term into some familiar, concrete, and easily reproducible word (e.g., CARPA is recoded as CARP), then to produce and rehearse a visual image involving the objects or events denoted by the code word and the response term (e.g., a visual image of a carp protruding from a tent). The keyword training emphasized the initiation of such a procedure under the conditions just

just described. The training was conducted in sessions ranging from 20 to 30 minutes in duration and spaced over a period of about 3 months. The training procedure was based largely on procedures developed by Jones (Note 1).

Training Session 1. The first session introduced imagery elaboration procedures (omitting the keyword stage) for PAL with 2 lists of 25 pairs each of unrelated, familiar, concrete nouns e.g., NEST-JAR. The students were first given one of the lists of pairs for a study period of about four minutes. Then they were tested for their memory of the response terms, given the stimulus items (mean recall was about 13 items). Following this experimenter stated that she could show the students a way to improve their performance through the use of image elaboration. This procedure was illustrated by describing various compound images that could be constructed from the pairs that had been studied. Students were called upon to think of additional images by which the items within each pair could be linked in an interactive image. Few students evidenced any difficulty in producing appropriate images. Next, the second list (with list order counter-balanced) was given under identical conditions as for the previous one except that the students were urged to use imagery in the way that had been discussed and practiced. Having demonstrated a sharp increase in perfor-mance ($\bar{X}$ = 20.90), the experimenter stated that she later would show the students how to use this technique with school tasks.

Training Session 2. In the second session students were given both keyword production and imagery elaboration practice using various terms and definitions which were considered to be appropriate for their social

science class. Examples are: "AVANT-GARDE - people with new ideas or inventions," "EXOGAMOUS -marrying outside one's clan or tribe." Students were told to identify keywords on the basis of acoustic or graphemic similarities between the stimulus item and some word with which they were familiar, (i.e., to find a familiar word of which the stimulus item reminded them) then to think of images involving the keyword referents and some critical aspect of the definitions. A set of social science terms was distributed to provide guided practice in these skills. Many of the students were unable to follow the instructions and became discouraged. Since these reactions a threatened and the entire experiment, the session was aborted and the task was examined to determine the cause of the failure. Our suspicion was that the critical factor in that failure was in the relatively abstract nature of the definitions that were given. The definition for EXOGAMOUS, for example, was understood immediately when a concrete example was provided orally by the experimenter.

Training Sessions 3 and 4. These sessions provided recoding and imagery elaboration training using a modified version of the one-bun technique for serial recall. In this task the students were given number-name pairs. The students had to link the surnames that were the response terms to numerals indicating serial order as the stimulus terms. This task differs from the traditional serial order task in that the numbers 1-10 were given during the learning and during the recall phases of the task so that, in effect, the task is essentially a PA task. Moeover, the training,

using this modified one-bun mnemonic, is only a slight extension of the paradim developed in the Raugh and Atkinson (1975) experiments in which the students had to learn three words: the foreign language word, its keyword asscciate, and the English translation of the foreign word. In the present study the students were instructed to recode the numerals with the traditional acoustic assoicates in the ONE-BUN mnemonic, also, they had to recode ONE as BUN, TWO as SHOE, and so on. Next, the students were instructed to link the acoustic associates from the one-bun mnemonic in an interactive images to an acoustic associate in the surnames. If the number-name pair was 1 - ROSEN, the student would link BUN and ROSE in an interactive image (e.g., a rose on a bun). Thus, the students were required to learn four words for each of 10 number-name pairs that were presented: the numeral (e.g., ONE), its acoustic associate (BUN) which is directly analogous do the keyword in the stimulus term in the Raugh and Atkinson paradigm, the surname (e.g., ROSEN), and an acoustic associate of the response term (ROSE) which functions as a second keyword. Since the target items were (surnames) low in imagery, the students were given instruction and practice in generating and using high imagery keywords for them, e.g., HAY for HAYES and COUGHING MAN for KAUFMAN.

This particular training was included at this point largely to combat the discouraging effects of Session 2 on some of the students. It was useful for that purpose because it was easy for the students to master and because the beneficial effect of its use was readily apparent. In addition, it gave practice in the most important components of the keyword methods: generating keywords and constructing interactive images.

Training Session 5. In this final training session we provided recoding and imagery elaboration training with pairs in which the stimuli were surnames and the responses were 5-6 word phrases describing events or occupations pertaining to those individuals. For example, one pair was "Oliver -- invented storm windows," and another was "Heartman -- was the first U.S. train engineer." The keyword training for this task required the students to link directly through interactive images the keyword in the surname with the complex information in the fact, i.e., information consisting of more than one part. In the first example above the learner would have to produce storm and window to be counted as a correct response. In the second example the learner would have to produce first and, train engineer. Thus, for this task the learner must construct a complex image which contains the keyword and referents for compound nouns, or more than one noun. The focal point of the training was teaching the students how to develop interactive images which truly reflected the meaning of the keyword and the complex information. It was pointed out, for example, that the image for the storm window must, in fact, be a storm window, not just an ordinary window. Similarly, in the second example above it is essential that the image somehow reflects the fact that the man is the first train engineer. He could be wearing a train engineer's uniform with a large "1" on it; he could also be driving a train.

After four demonstration examples, the students were instructed to learn 12 name-fact pairs, type-written on a single sheet of paper, using the keyword method. The students were given a 3-minute study period, followed by a test in which only the surnames, randomly reordered, were

given. After the recall period, the students were instructed to describe in writing the images that they had constructed for each name-fact pair. The experimenter subsequently discussed appropriate and inappropriate images for each pair using examples that the students had constructed themselves.

Keyword Practice in the Control Condition

In separate sessions the control students were given the two practice tasks that the keyword group received: the list of 10 number-name pairs and the list of 12 name-fact pairs. These tasks were identical in content, study time, and format as those given to the keyword group. The instructions emphasized that the students were to learn pairs of unrelated terms, described in detail the procedure to be used, and gave a random order examples of correct and incorrect answers.

The scheduling of these practice tasks and the posttests described below were synchronized exactly with the scheduling of the practice tasks and posttests for the keyword group. That is, the control group received the Number-Name practice task in their fourth (cross-classification training) session and the Names and Fact practice task in their fifth session. The two posttests were similarly synchronized. The control students were given feedback regarding correct and incorrect responses on each test except the last one in subsequent sessions.

Posttests

Two tests were given to assess the effects of training on spontaneous strategy use. In both cases the materials and procedures employed were

identical for all of the students, and no instructions or prompts regarding the use of the keyword method were given. The first of these tasks involved surnames as stimuli and facts as responses, and was given one week following practice to both groups on precisely that type of task (see training session 5). Examples of pairs used are "Hamilton -- designed the Coca Cola bottle," and "Finley -- tested a plastic heart." Sample pairs were used to illustrate the level of detail required to obtain credit for a response. For example, the responses "Coca Cola" or "bottle" would be insufficient in the case of Hamilton. The 15 test pairs of the Names and Facts test then were presented typewritten on a single sheet of paper for a 2.5-minute study period, followed by a test in which only the names were given (reordered). The students were instructed to write in the appropriate information concerning each. The test was administered to the two groups on separate occasions on the same day by the experimenter.

The second test task consisted of the names of 14 diseases and brief definitions of each. Although some terms were "vaguely familiar" to the students, the definitions were unfamiliar at the outset. Examples of items are "Duodenitis -- inflammation of the intestines," and "Threadworms -- affect the digestive tacts mostly of children." Following instructions regarding criteria for judging answers as correct, the students were given a typewritten list of the items for a 2-minute study period. At the signal immediately following the study period, the students were instructed to fold the study lists underneath the test booklet. This procedure removed the study lists from sight and simultaneously exposed the test list

containing only the disease terms. The students were given unlimited time to write in the definitions. This Medical Definitions test was administered by the experimenter in separate sessions for the two groups, and was given two weeks following the Names and Facts test. The only training that had been given on the use of the keyword method for learning definitions of technical terms had occurred 12 weeks earlier in the second training session. Further, that earlier training (in session 2) had not been completed, and it was a different subject area (social studies).

Results

Training Session Observations

Before addressing questions regarding the effectiveness of the keyword method on posttraining tests a consideration of performance during training is pertinent. The primary issue here is the extent to which the training exercises resulted in the "proper" use of the method. That is, did the students learn to generate appropriate keywords and images linking those keywords to the response terms? The data regarding these questions were obtained by the experimenter in the course of her conducting the training sessions and thus are in the form of informal observations. During training sessions 1-4 the experimenter inspected student work sheets during and after the sessions, questioned students about the keywords and images generated, and answered student queries. Student answer sheets also were inspected following training session 5. Except for training session 2, steady improvement in, and increased use of the keyword method was observed as training progressed. In particular, keywords were generated

increasingly rapidly, they were increasingly concrete and amenable to the production of useful images, and more compound images were reported.

Results

Recall that for each test task the responses were phrases, rather than single words, and that in many cases two components were considered essential for full credit. For such items if only one of the components was present in a student's response, that response received half credit. Consider, for example, the item "Ballad - supported slavery" from the Names and Facts test. A response that indicated that Ballard had something to do with slavery, but did not specify the notion of support received a score of .5. However, verbatim recall of essential components was not required. Thus, for example, the response "Worked for slavery" received full credit. A total of 15 points was possible on test 1 (Names and Facts) and 14 points on test 2 (Medical Definitions).

The results are summarized in Table 1. For both tests the performance of the experimental condition was significantly ($p<.01$) greater than for the control condition, t (42) = 6.48 for test 1 and t (42) = 2.79 for test 2. The magnitudes of these training effects are impressive, the experimental group exceeding the control group by 40% on test 1 and by 36% on test 2. And for test 1 the magnitude of the true effect very likely is underestimated due to a ceiling effect. The mean number of errors for the experimental group was only 2.6 and the standard deviation of that group was considerably lower than for the control condition. In another respect, though the effect found on test 2 was more impressive, the experimental group had received no keyword training on items involving medical terms.

group had received no keyword training on items involving medical terms. They had received training on definitions of technical social science terms (e.g., POLYGYNY), and such training could be expected to generalize to the medical terms. However, that training occurred 12 weeks prior to test 2, and no keyword training of any sort had been given during the three-week period immediately preceding test 2.

Because of practical restrictions we were unable to institute the full range of experimental controls and to be as analytical as would have been ideal. We must, therefore, be particularly attentive to alternative explanations for our results. The students were not assigned randomly to conditions. Were the experimental students generally a more able group? The reading achievement scores cited earlier suggest not. It is also extremely doubtful that the performance differences could be accounted for by general motivational differences, since the experimenter met as frequently with the control students to provide organizational strategy training as with the experimental students to provide keyword strategy training. And, as has been described separately (Jones & Hall, Note 1), the organizational training group (our control group here) consistently matched or exceeded the keyword group on tasks appropriate to the organizational strategy.

It is likely that the superior performance of the keyword group was the result of greater total practice with paired-associate tasks during the course of training and that the keyword aspect of the training was not essential to that effect? That seems implausible from several perspec-

tives. First, both groups had equivalent practice with Number-Name practice test and with the Names and Facts tasks prior to the posttraining testing. Further, prior to the Medical Definitions test the experimental group had only one previous training session involving definitions, and that session occurred 12 weeks earlier and was only partially completed. The second point against a "sheer practice" interpretation is that it seems most likely that tasks involving memory for definitions and the association of facts with names were highly familiar ones to all of the students. The relatively small amount of "sheer practice" received during this period seems unlikely to have had any measurable impact given all the prior (and concurrent) practice with such tasks.

Third, we know from the written descriptions of interactive images for the names and facts practice test that all of the keyword students knew how to produce appropriate interactive images for that task. Finally, considering the difficulty of the task, it seems highly unlikely that the keyword group could have obtained such high scores without using this method. Raugh and Atkinson (1975) gave the college students in their experiments a total of 15 seconds per set to learn sets consisting of only three words (one of which was the keyword), and two of the three words were concrete/familiar. In the Names and Facts test these eighth graders had 12 seconds per set to learn 15 names paired with phrases of 5-6 words without the advantage of having the keyword provided. In the Medical Definitions test, which involved largely unfamiliar names and complex information in the definition, the students had only 9 seconds to learn each disease -

definition pair. That they were able to learn 83% and 73% of the information on the two tests under such challenging test conditions suggests that practice alone did not yield these effects.

Discussion

The experiment suggests important generalization regarding the educational potential of the keyword method. First, the utility of the method extends well beyond the foreign language vocabulary task with which it was first demonstrated. The two tests for which we found it effective here both are prototypical of school tasks commonly found from the late elementary grades through high school and even college. These results encourage further exploration of the method's utility in various educational contexts. It also is encouraging from an educational perspective to find that the effectiveness of the technique at the secondary school level is not contingent on supplying keywords for the student. This suggest far less dependency on especially prepared instructional materials.

Perhaps the most impressive finding was the nonspecific transfer of the method to similar tasks over a period of several weeks. That is, the keyword training resulted in the acquistion of the technique as a strategy that was initiated subsequently under appropriate conditions and without explicit prompting. This is a finding of considerable importance, since the utility of the technique will be far greater if the student can be taught to initiate it under appropriate conditions rather than its application being dependent on specific instuctions from the teacher on each such

occasion, or on especially designed instructional material. Our data are encouraging in that regard. The finding is interesting, too, in its implications regarding the adolescent as a strategist. Evidently there are a substantial number of 13-year-olds who are able to acquire relatively complex memory strategies through carefully designed, but educationally practical, instructional programs. We regard the program as educationally practical since it required only a few hours and seems well within the capabilities of nearly all teachers to handle.

There are a number of additional questions that require answers before widespread implementation of instruction based on the keyword method is warranted. One set of questions concerns the nature of materials for which the method is effective. For what proportion of stimulus items of a particular class (e.g., Spanish nouns) can keywords be generated with sufficient rapidity and reliability to make the keyword method more effective than standard study approaches? Are there likely to be special problems of negative transfer? To what extent would the use of verbal rather than imaginal, elaboration be effective in the case of abstract (low imagery) items? Question remain regarding the teaching and use of the keyword method as a learning strategy. Our experiment demonstrated nonspecific transfer from such training, but we do not know which elements of the training were critical for that effect, the maximum interval over which transfer would be observed, the extent to which training on items of one "type" would influence performance on items of a different type, or the relationship of various subject variables (e.g., age) to transfer effects.

What is required, it seems to use, is a carefully conceived systematic attack on questions such as these. Such an approach is represented by the recent work of Pressley and Levin (Pressley, 1977; Pressley and Levin, in press) and by this and other as yet unpublished experiments conducted at Northwestern.

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Table 1

Performance of the Keyword and Control Groups on the Names and Facts Test (Test 1) and the Definitions Test (Test 2)

Test		Keyword Group	Control Group
1-Names and Facts	X	13.40	8.90
	SD	1.45	3.82
2-Medical Definitions	X	10.21	7.52
	SD	3.29	3.17